The Ulster Medical Journal, Volume 72, No. 1, pp. 48-49, May 2003.

Case Report

Hyperglycaemia, glycosuria and ketonuria may not be diabetes

J Gray, A Bhatti, J M O'Donohoe

Accepted 20 November 2002

Diabetic ketoacidosis is a well recognised, important, but rare differential diagnosis of acute abdominal pain in children. We report a case highlighting the need for complete assessment of any child presenting with new-onset glycosuria, ketonuria and hyperglycaemia. Causes other than diabetes may rarely produce these findings.

CASE REPORT A girl aged three years and ten months with a six-hour history of abdominal pain and vomiting was referred to the surgical team by a general practitioner. Past medical history included a diagnosis of non-specific abdominal pain at three years old. There was no significant family history nor recent illness in the family circle.

On examination she was restless and thirsty, but apyrexic. There was no foetor or rash. She had grunting respiration with tachypnoea, but the lungs were clear on auscultation. Her abdomen was soft with mild generalised tenderness and no localised guarding or rebound in any quadrant. Urine dipstick analysis showed three pluses of ketones and three pluses of glucose. Blood glucose was 16 mmol/L on ward testing.

Further history suggested thirst earlier in the day and possibly some recent weight loss. With this history, and initial findings a paediatric medical opinion was sought regarding a diagnosis of diabetes mellitus. Laboratory blood glucose was 16.3mmol/L. Acid base balance was normal with a blood gas pH of 7.38, and base excess of -1.Blood count, electrolytes, abdominal and chest radiographs were all normal. CRP was elevated at 88.9mg/L.

On the basis of these results repeat abdominal examination was undertaken three hours after admission. At this time her temperature was 37.6C, again she had generalised abdominal tenderness, maximal in the lower abdomen now with associated guarding and rebound.

A presumptive diagnosis of acute appendicitis was made and an exploratory laparotomy undertaken through a lower mid line incision. A perforated appendix was found along with pus in the peritoneal cavity. Appendicectomy and peritoneal lavage were performed.

Postoperative recovery was uneventful, and she was discharged home on the third postoperative day. Subsequent random blood glucose was normal at 4.6mmol/L. Her HbAlc was normal while islet cell antibodies were negative. At review she was well, with no complaints or complications.

DISCUSSION

Rarely diabetic ketoacidosis may present with acute abdominal pain.[1] As this is an important diagnosis it is listed in most surgical and medical textbooks.

The absence of any acid-base disturbance, ruled out the diagnosis of diabetic ketoacidosis in this little girl. No active infection could be identified in her ears, throat, respiratory or urinary tracts, but an elevated CRP indicated the presence of an acute inflammatory process. "Active observation", an important concept in patients with abdominal pain, identified the emerging peritonism requiring surgery.[3]

The Erne Hospital Enniskillen, Co. Fermanagh, BT75 6AY.

J Gray, MA, MB, MRCS, Senior House Officer

A Bhatti, MB, FRCS, FRCS(Gen), Consultant Surgeon

J M O'Donohoe, MB, MRCP, FRCPCH, Consultant Paediatrician

Correspondence to Mr Gray, 81 Donnybrook Street, Belfast BT9 7DE.

The systemic stress response is well recognised, particularly in critical care medicine. Trauma, burns or unresolved infection are all causes. This hypermetabolic state is associated with enhanced peripheral glucose uptake and utilization, increased gluconeogenesis, depressed glycogenesis, glucose intolerance and insulin resistance. Hormones such as glucagon, cortisol and epinephrine, as well as cytokines all play a role. These changes may be viewed as maintaining glucose to the wound and immune tissues.[4]

The absence of islet autoantibodies makes an immediate or future diagnosis of type 1 diabetes unlikely.[5] In the absence of any incipient diabetes, the metabolic disturbance of this child was presumably a stress response that settled rapidly when the underlying cause was treated. Hyperglycaemia to such a high level (>16.7) as a stress response, is unusual. In a study of children with burns to >60% body surface area, such high blood glucose levels occurred in less than 7% of children.[6] In the absence of any acid-base disturbance we presume our patient's ketonuria was due to starvation ketones which occur after a period of fasting.

No surgical or paediatric textbook we consulted discusses this stress response as a differential diagnosis for hyperglycaemia and glycosuria in children.[7,8] The learning point is that a child can rarely present with the triad of hyperglycaemia, glycosuria and ketonuria without a diagnosis of diabetes or diabetic ketoacidosis. Two mechanisms, are at work, namely a stress response and starvation ketones. The key factor is the absence of metabolic acidosis. In such cases the underlying cause inducing the metabolic stress response must be identified and treated.

REFERENCES

1. Jones P F. Suspected acute appendicitis: trends in management over 30 years. *Br J Surg* 2001 Dec; **88(12)**: 1570-7.
2. Paterson-Brown S. The acute abdomen. In: Burnand K G, Young A E, editors. The New Aird's companion in surgical studies. 2nd ed. London: Churchill Livingstone; 1998. p.693-762.
3. Jones P F. Active observation in management of acute abdominal pain in childhood. *Br Med J* 1976 Sep 4; **2(6035)**: 551-3.
4. Mizock B A. Alterations in carbohydrate metabolism during stress: a review of the literature. *Am J Med* 1995 Jan; **98(1)**: 75-84.
5. Lorini R, Alibrandi A, Vitali L, Klersy C, Martinetti M, Betterle C, *et al.* Risk of type 1 diabetes development in children with incidental hyperglycemia: A multicenter Italian study. *Diabetes Care* 2001 Jul; **24(7)**: 1210-6.
6. Gore D C, Chinkes D, Heggers J, Herridon D N, Wolf S E, Desai M. Association of hyperglycemia with increased mortality after severe bum injury. *J Trauma* 2001 Sep; **51(3)**: 540-4.
7. Campbell A G M, McIntosh N, editors. Forfar and Arneil's Textbook of paediatrics. Edinburgh: Churchill Livingstone; 1992.
8. O'Neill, Rowe, Grosfeld. Paediatric Surgery (5th Edition), Mosby: New York; 1998.